PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-105332

(43)Date of publication of application : 09.04.2003

(51)Int.Cl. C09K 11/06
H05B 33/14

(21)Application number : 2001-299531

(22)Date of filing : 28.09.2001

(71)Applicant : CANON INC

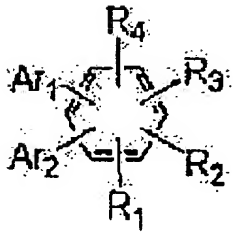
(72)Inventor : SUZUKI KOICHI
SENOO AKIHIRO

(54) ORGANIC LIGHT-EMITTING ELEMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic light-emitting element assuming various kinds of light-emitting hues, affording light emission with a high luminance at a low application voltage and having excellent durability.

SOLUTION: This organic light-emitting element comprises at least one layer containing a condensed polycyclic compound represented by general formula (I) (wherein, R1, R2, R3 and R4 denote each hydrogen atom, an alkyl group, a substituted or an unsubstituted aralkyl group, a substituted or an unsubstituted aryl group, a substituted or an unsubstituted heterocyclic group, a substituted amino group or cyano group; R1, R2, R3 and R4 may be the same or different; Ar1 and Ar2 denote each a substituted or an unsubstituted condensed polycyclic aromatic group or a substituted or an unsubstituted condensed polycyclic heterocyclic group; at least one of Ar1 and Ar2 denotes a substituted or an unsubstituted fluoranthenyl group; and Ar1 and Ar2 may be the same or different) in layers composed of an organic compound.



(I)

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

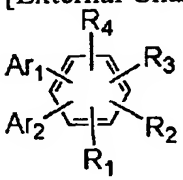
[Date of extinction of right]

* NOTICES *

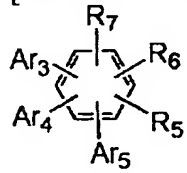
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [I] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.
General formula [I]
[External Character 1]



(R1, R2, R3, and R4 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R1, R2, R3, and R4 are the same, they may differ. Ar1 and Ar2 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar1 and the Ar2 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar1 and Ar2 are the same, they may differ.
[Claim 2] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [II] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.
General formula [II]
[External Character 2]



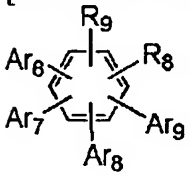
(R5, R6, and R7 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R5, R6, and R7 are the same, they may differ. Ar3, Ar4, and Ar5 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at

least one of Ar3, Ar4, and the Ar5 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar3, Ar4, and Ar5 are the same, they may differ.

[Claim 3] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [III] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.

General formula [III]

[External Character 3]

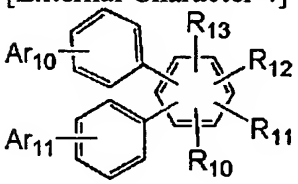


(R8 and R9 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R8 and R9 are the same, they may differ. Ar6, Ar7, Ar8, and Ar9 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar6, Ar7, Ar8, and the Ar9 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar6, Ar7, Ar8, and Ar9 are the same, they may differ.

[Claim 4] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [IV] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.

General formula [IV]

[External Character 4]

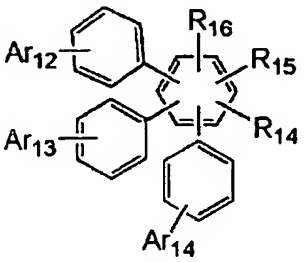


(R10, R11, R12, and R13 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R10, R11, R12, and R13 are the same, they may differ. Ar10 and Ar11 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar10 and the Ar11 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar10 and Ar11 are the same, they may differ.

[Claim 5] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [V] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.

General formula [V]

[External Character 5]

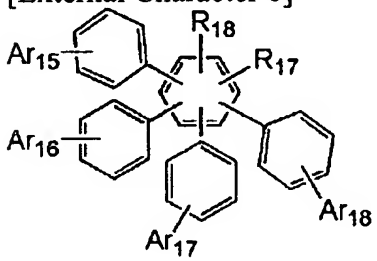


(R14, R15, and R16 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R14, R15, and R16 are the same, they may differ. Ar12, Ar13, and Ar14 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar12, Ar13, and the Ar14 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar12, Ar13, and Ar14 are the same, they may differ.

[Claim 6] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VI] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.

General formula [VI]

[External Character 6]

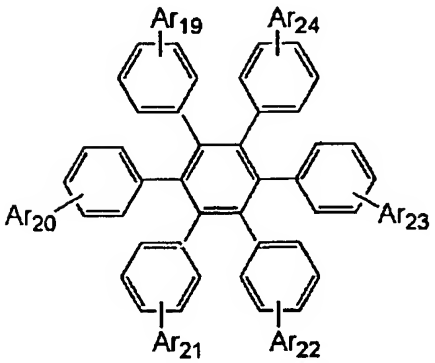


(R17 and R18 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R17 and R18 are the same, they may differ. Ar15, Ar16, Ar17, and Ar18 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar15, Ar16, Ar17, and the Ar18 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar15, Ar16, Ar17, and Ar18 are the same, they may differ.

[Claim 7] The organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VII] in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] for which a kind is contained at least.

General formula [VII]

[External Character 7]



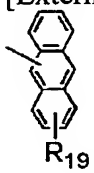
(Ar19, Ar20, Ar21, Ar22, Ar23, and Ar24 express among a formula the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or / a permutation, or], and at least one of Ar19, Ar20, Ar21, Ar22, Ar23, and the Ar24 expresses the fluoran thenyl radical which is not permuted [a permutation or].) Even if Ar19, Ar20, Ar21, Ar22, Ar23, and Ar24 are the same, they may differ.

[Claim 8] The organic light emitting device according to claim 1 to 7 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical which the three or more benzene rings which are not permuted [a permutation or] condensed.

[Claim 9] The organic light emitting device according to claim 8 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [VIII].

General formula [VIII]

[External Character 8]

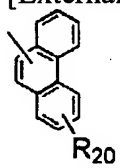


(R19 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)

[Claim 10] The organic light emitting device according to claim 8 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [IX].

General formula [IX]

[External Character 9]

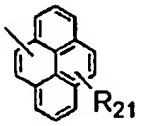


(R20 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)

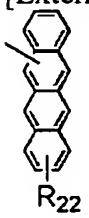
[Claim 11] The organic light emitting device according to claim 8 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [X].

General formula [X]

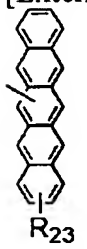
[External Character 10]



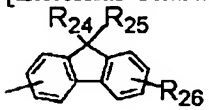
(R21 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
[Claim 12] The organic light emitting device according to claim 8 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XI].
General formula [XI]
[External Character 11]



[Claim 13] The organic light emitting device according to claim 8 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XII].
General formula [XII]
[External Character 12]



(R23 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
[Claim 14] The organic light emitting device according to claim 1 to 7 whose Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XIII].
General formula [XIII]
[External Character 13]



(R24, R25, and R26 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
[Claim 15] The organic light emitting device according to claim 1 to 7 to which an electronic transportation layer or a luminous layer is characterized by the thing of the condensed multi-ring compound shown by a general formula [I], a general formula [II], a general formula [III], the general formula [IV], the general formula [V], the general formula [VI], and the general formula [VII] for which a kind is contained at least at least among the layers which consist of an organic compound.

[Translation done.]

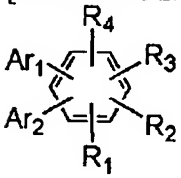
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

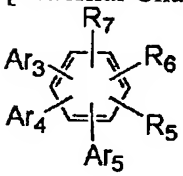
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the organic light emitting device using a new organic compound and new it.
[0002]
[Description of the Prior Art] An organic light emitting device is a component using the light emitted in case the exciton of a fluorescence compound is made to generate and this exciton returns to a ground state by making the thin film containing a fluorescence organic compound pinch, and pouring in an electron and a hole (electron hole) from each electrode between an anode plate and cathode.
[0003] About two 1000 cd/m luminescence is reported by the component of the functional discrete-type two-layer configuration which used ITO for the anode plate, used the alloy of magnesium silver for cathode in research (Appl.Phys.Lett.51,913 (1987)) of KODAKKU in 1987, respectively, and used the triphenylamine derivative for the hole transportation ingredient, using an aluminum quinolinol complex as an electronic transportation ingredient and a luminescent material in about [10V] applied voltage. As a patent of relation, U.S. Pat. No. 4, No. 539 or 507, U.S. Pat. No. 4,720,432, a U.S. Pat. No. 4,885,211 number, etc. are mentioned.
[0004] Moreover, by changing the class of fluorescence organic compound, luminescence from ultraviolet to infrared rays is possible, and, recently, research of various compounds is done actively. For example, it is indicated by a U.S. Pat. No. 5,151,629 number, a U.S. Pat. No. 5,409,783 number, a U.S. Pat. No. 5,382,477 number, JP,2-247278,A, JP,3-255190,A, JP,5-202356,A, JP,9-202878,A, JP,9-227576,A, etc.
[0005] Furthermore, the organic light emitting device which used the conjugated-system giant molecule other than an organic light emitting device using the above low-molecular ingredients is reported by the group (Nature, 347,539 (1990)) of Cambridge University. By this report, luminescence is checked by the monolayer by forming polyphenylene vinylene (PPV) by the coating system. As a related patent of the organic light emitting device using a conjugated-system macromolecule, a U.S. Pat. No. 5,247,190 number, a U.S. Pat. No. 5,514,878 number, a U.S. Pat. No. 5,672,678 number, JP,4-145192,A, JP,5-247460,A, etc. are mentioned.
[0006] Thus, the latest advance in an organic light emitting device is remarkable, and the description has suggested the possibility from the versatility of high brightness and luminescence wavelength, high-speed responsibility, a thin shape, and the lightweight formation of a luminescence device being possible to an extensive application with low applied voltage.
[0007] However, the further optical output or the high conversion efficiency of high brightness is required of the present condition. Moreover, there are still many problems in respect of endurance, such as degradation by an ambient atmosphere gas, moisture, etc. containing aging and oxygen by use of long duration. Although luminescence of the good blue of the color purity at the time of furthermore considering the application to a full color display etc., green, and red is needed, still, it is not enough about these problems.
[0008] As a fluorescence organic compound used for an electronic transportation layer, a luminous layer, etc., many aromatic compounds and condensed multi-ring aromatic compounds are studied. For example, although JP,4-68076,A, JP,5-32966,A, JP,6-228552,A, JP,6-240244,A, JP,7-109454,A, JP,8-311442,A, JP,9-241629,A, JP,2000-26334,A, JP,2000-268964,A, etc. are mentioned, what luminescence brightness and endurance can fully satisfy is not obtained.

[0009]
[Problem(s) to be Solved by the Invention] a condensed multi-ring compound [**** / this invention] -- using -- very -- efficient -- high -- it is in offering the organic light emitting device which has a brightness optical output. Moreover, it is in offering an extremely durable organic light emitting device. It is in offering the organic light emitting device which manufacture can furthermore create comparatively cheaply easily.
[0010]
[Means for Solving the Problem] Therefore, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [I] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0011] General formula [I]
[External Character 14]

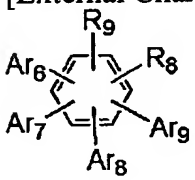


[0012] (R1, R2, R3, and R4 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R1, R2, R3, and R4 are the same, they may differ. Ar1 and Ar2 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar1 and the Ar2 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar1 and Ar2 are the same, they may differ. Again this invention In the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair] At least one layer of the layers containing said organic compound offers the organic light emitting device characterized by the thing of the condensed multi-ring compound shown by the following general formula [II] for which a kind is contained at least.
[0013] General formula [II]
[External Character 15]

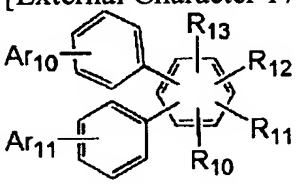


[0014] (R5, R6, and R7 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R5, R6, and R7 are the same, they may differ. Ar3, Ar4, and Ar5 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar3, Ar4, and the Ar5 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar3, Ar4, and Ar5 are the same, they may differ.
Moreover, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [III] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].

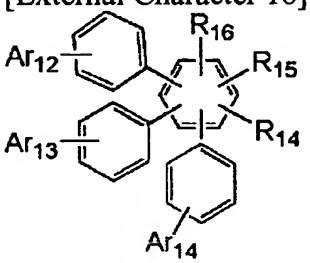
[0015] General formula [III]
[External Character 16]



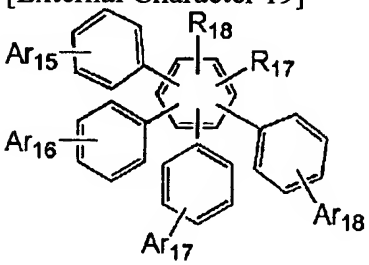
[0016] (R8 and R9 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R8 and R9 are the same, they may differ. Ar6, Ar7, Ar8, and Ar9 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar6, Ar7, Ar8, and the Ar9 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar6, Ar7, Ar8, and Ar9 are the same, they may differ.
Moreover, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [IV] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0017] General formula [IV]
[External Character 17]



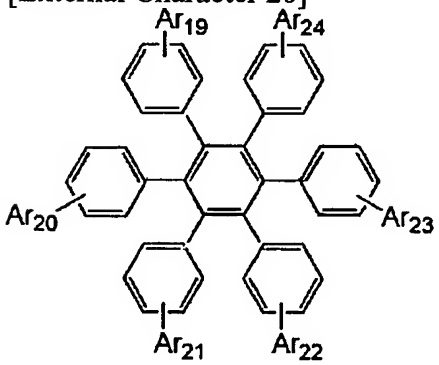
[0018] (R10, R11, R12, and R13 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R10, R11, R12, and R13 are the same, they may differ. Ar10 and Ar11 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar10 and the Ar11 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar10 and Ar11 are the same, they may differ.
Moreover, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [V] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0019] General formula [V]
[External Character 18]



[0020] (R14, R15, and R16 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R14, R15, and R16 are the same, they may differ. Ar12, Ar<SUB>13, and Ar14 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or / a permutation, or], and at least one of Ar12, Ar13, and the Ar14 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar12, Ar13, and Ar14 are the same, they may differ.
Moreover, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VI] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0021] General formula [VI]
[External Character 19]



[0022] (R17 and R18 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R17 and R18 are the same, they may differ. Ar15, Ar16, Ar17, and Ar18 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar15, Ar16, Ar17, and the Ar18 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar15, Ar16, Ar17, and Ar18 are the same, they may differ.
Moreover, this invention offers the organic light emitting device characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VII] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0023] General formula [VII]
[External Character 20]



[0024] (Ar19, Ar20, Ar21, Ar22, Ar23, and Ar24 express among a formula the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or / a permutation, or], and at least one of Ar19, Ar20, Ar21, Ar22, Ar23, and the Ar24 expresses the fluoran thenyl

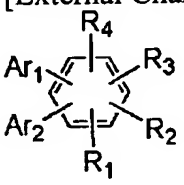
radical which is not permuted [a permutation or].) Even if Ar19, Ar20, Ar21, Ar22, Ar23, and Ar24 are the same, they may differ.

[0025]

[Embodiment of the Invention] The organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [I] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].

[0026] General formula [I]

[External Character 21]

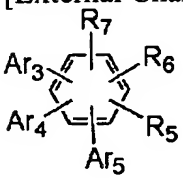


[0027] (R1, R2, R3, and R4 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R1, R2, R3, and R4 are the same, they may differ. Ar1 and Ar2 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar1 and the Ar2 expresses a fluoran thenyl radical. Even if Ar1 and Ar2 are the same, they may differ.

Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [II] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].

[0028] General formula [II]

[External Character 22]

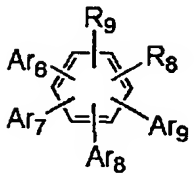


[0029] (R5, R6, and R7 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R5, R6, and R7 are the same, they may differ. Ar3, Ar4, and Ar5 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar3, Ar4, and the Ar5 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar3, Ar4, and Ar5 are the same, they may differ.

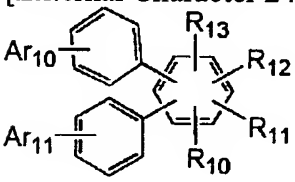
Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [III] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].

[0030] General formula [III]

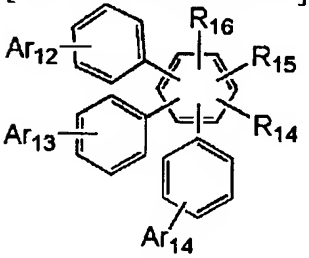
[External Character 23]



[0031] (R8 and R9 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R8 and R9 are the same, they may differ. Ar6, Ar7, Ar8, and Ar9 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar6, Ar7, Ar8, and the Ar9 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar6, Ar7, Ar8, and Ar9 are the same, they may differ.
Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [IV] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0032] General formula [IV]
[External Character 24]

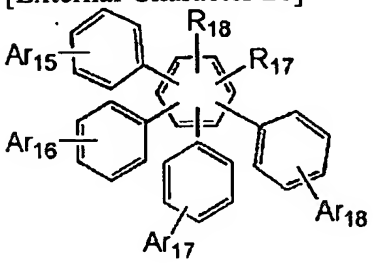


[0033] (R10, R11, R12, and R13 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R10, R11, R12, and R13 are the same, they may differ. Ar10 and Ar11 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar10 and the Ar11 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar10 and Ar11 are the same, they may differ.
Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [V] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0034] General formula [V]
[External Character 25]

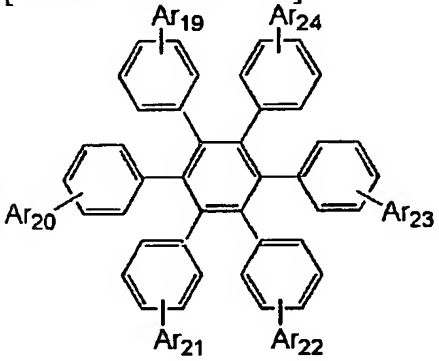


[0035] (R14, R15, and R16 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation,

or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R14, R15, and R16 are the same, they may differ. Ar12, Ar13, and Ar14 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar12, Ar13, and the Ar14 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar12, Ar13, and Ar14 are the same, they may differ.
Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VI] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0036] General formula [VI]
[External Character 26]

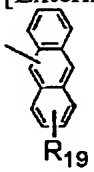


[0037] (R17 and R18 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.) Even if R17 and R18 are the same, they may differ. Ar15, Ar16, Ar17, and Ar18 express the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or /, a permutation, or], and at least one of Ar15, Ar16, Ar17, and the Ar18 expresses the fluoran thenyl radical which is not permuted [a permutation or]. Even if Ar15, Ar16, Ar17, and Ar18 are the same, they may differ.
Moreover, the organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the following general formula [VII] for which a kind is contained at least in the organic light emitting device which has at least the layer which consists of an electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were pinched by inter-electrode [of this pair].
[0038] General formula [VII]
[External Character 27]

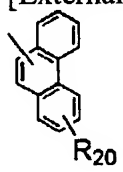


[0039] (Ar19, Ar20, Ar21, Ar22, Ar23, and Ar24 express among a formula the condensed multi-ring heterocycle radical which is not permuted [the condensed multi-ring aromatic series radical which is not permuted / a permutation or / a permutation, or], and at least one of Ar15, Ar16, Ar17, and the Ar18 expresses the fluoran thenyl radical which is not permuted [a permutation or].) Ar15, Ar16, Ar17, and Ar18 -- even if the same, you may differ.
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a

general formula [VII] are the condensed multi-ring aromatic series radical which the three or more benzene rings which are not permuted [a permutation or] condensed.
[0040] As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [VIII].
[0041] General formula [VIII]
[External Character 28]

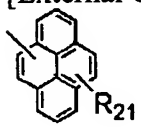


[0042] (R19 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [IX].
[0043] General formula [IX]
[External Character 29]

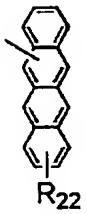


[0044] (R20 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [X].

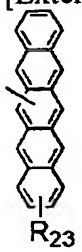
[0045] General formula [X]
[External Character 30]



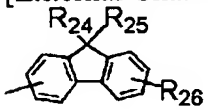
[0046] (R21 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XI].
[0047] General formula [XI]
[External Character 31]



[0048] (R22 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XII].
[0049] General formula [XII]
[External Character 32]



[0050] (R23 expresses among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
As for the organic light emitting device of this invention, it is desirable that Ar1-Ar24 of a general formula [I] - a general formula [VII] are the condensed multi-ring aromatic series radical shown by the following general formula [XIII].
[0051] General formula [XIII]
[External Character 33]



[0052] (R24, R25, and R26 express among a formula the heterocycle radical which is not permuted [the aryl group which is not permuted / the aralkyl radical which is not permuted / a hydrogen atom, an alkyl group, a permutation, or /, a permutation, or /, a permutation, or], the permutation amino group, or a cyano group.)
The organic light emitting device of this invention has at least the desirable thing of the condensed multi-ring compound in which an electronic transportation layer or a luminous layer is shown by a general formula [I], a general formula [II], a general formula [III], the general formula [IV], the general formula [V], the general formula [VI], and the general formula [VII] for which a kind is contained at least among the layers which consist of an organic compound. The example of the substituent in the above-mentioned general formula [I] - a general formula [VII] is shown below.
[0053] As an alkyl group, a methyl group, an ethyl group, n-propyl group, an iso-propyl group, n-butyl, ter-butyl, an octyl radical, etc. are mentioned.
[0054] Benzyl, a phenethyl radical, etc. are mentioned as an aralkyl radical.
[0055] As an aryl group, a phenyl group, a biphenyl radical, a terphenyl radical, a naphthyl group, an anthryl radical, a phenan thrill radical, a pyrenyl radical, a tetra-SENIRU radical, a pen TASENIRU radical, a fluorenyl group, etc. are mentioned.
[0056] As a heterocycle radical, a thienyl group, a pyrrolyl radical, a pyridyl radical, a quinolyl radical, a carbazolyl

radical, an oxazolyl radical, an oxadiazolyl radical, a thiazolyl radical, a thiadiazolyl radical, a TACHI enyl radical, a TAPIRORIRU radical, etc. are mentioned.

[0057] As a permutation amino group, a dimethylamino radical, a diethylamino radical, a dibenzylamino radical, a diphenylamino radical, a ditolylamino radical, the JIANISORIRU amino group, etc. are mentioned.

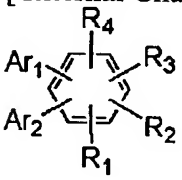
[0058] As a substituent which the above-mentioned substituent may have, alkyl groups, such as a methyl group, an ethyl group, and a propyl group, Aralkyl radicals, such as benzyl and a phenethyl radical, a phenyl group, a naphthyl group, An anthryl radical, a phenan thrill radical, a pyrenyl radical, a tetra-SENIRU radical, a pen TASENIRU radical, Heterocycle radicals, such as aryl groups, such as a fluorenyl group, a thienyl group, a pyrrolyl radical, and a pyridyl radical, A dimethylamino radical, a diethylamino radical, a dibenzylamino radical, a diphenylamino radical, Alkoxyl groups, such as amino groups, such as a ditolylamino radical and a JIANISORIRU amino group, a methoxyl group, ethoxyl, propoxyl, and a phenoxyl radical, a cyano group, a nitro group, etc. are mentioned.

[0059] Next, although the example of representation of the condensed multi-ring compound of this invention is given to below, this invention is not limited to these.

[0060] [The example of a compound of this operation gestalt]

General formula [I]

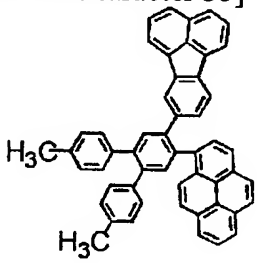
[External Character 34]



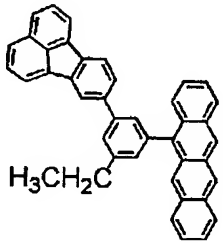
[0061]

[External Character 35]

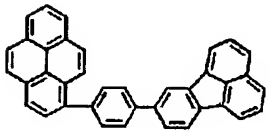
1



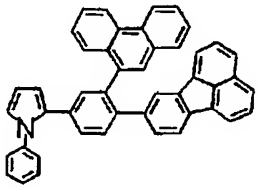
4



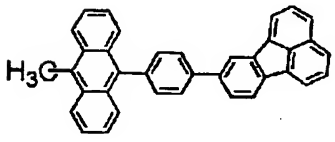
2



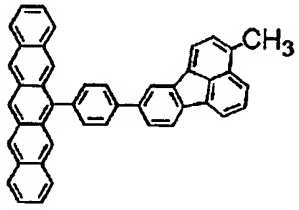
5



3

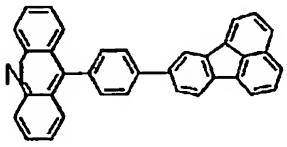


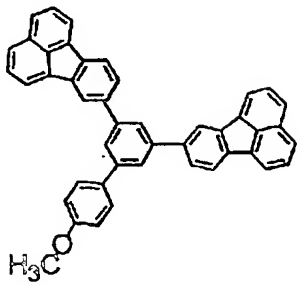
6



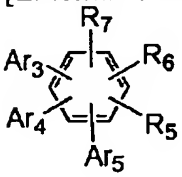
[0062]

[External Character 36]

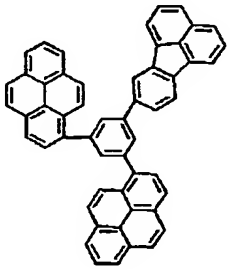
7 

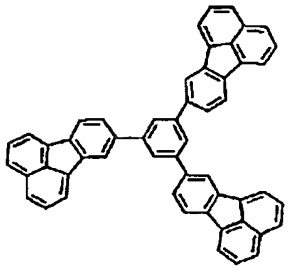
8 

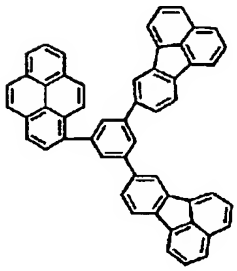
[0063] General formula [II]
[External Character 37]

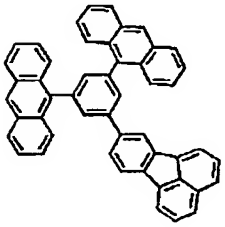


[0064]
[External Character 38]

9 

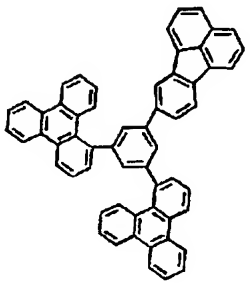
11 

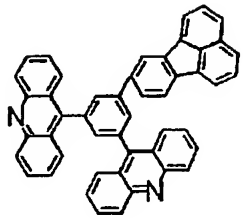
10 

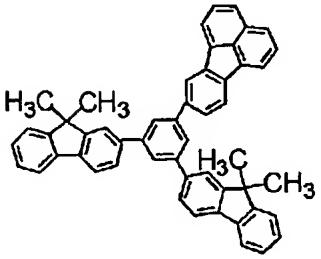
12 

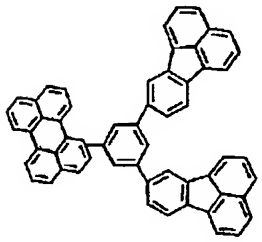
[0065]
[External Character 39]

[0066]
[External Character 40]

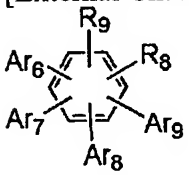
19 

22 

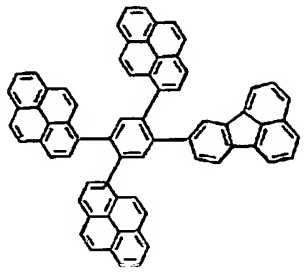
20 

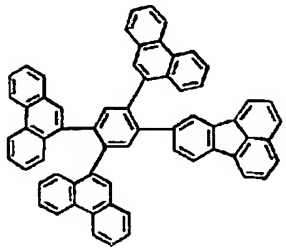
21 

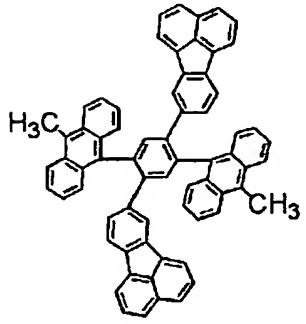
[0067] General formula [III]
[External Character 41]

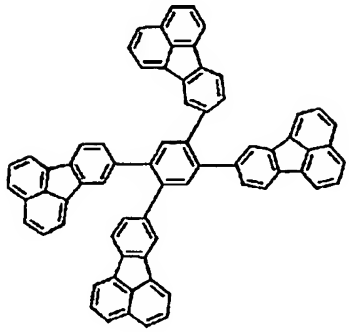


[0068]
[External Character 42]

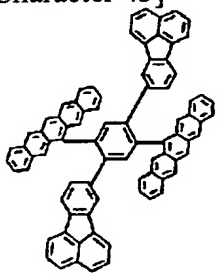
23 

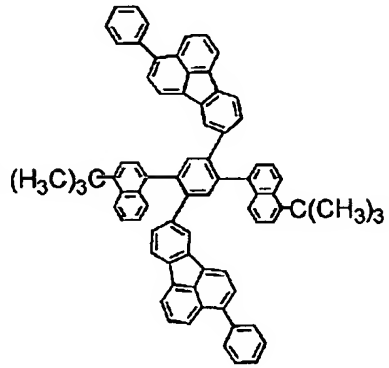
25 

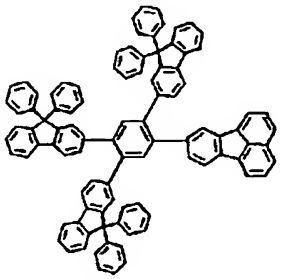
24 

26 

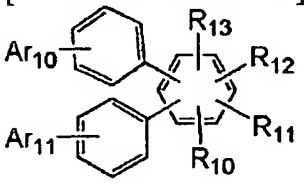
[0069]
[External Character 43]

27 

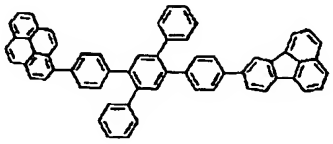
29 

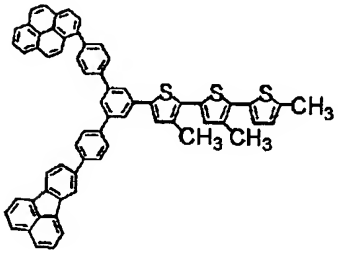
28 

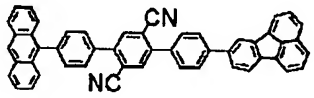
[0070] General formula [IV]
[External Character 44]

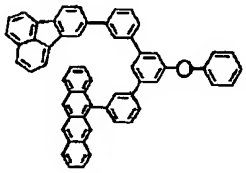


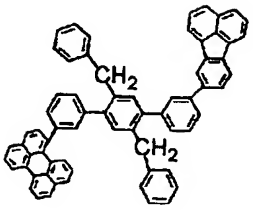
[0071]
[External Character 45]

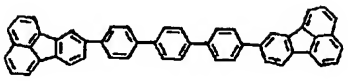
30 

31 

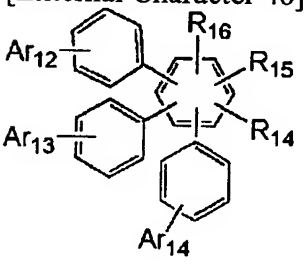
32 

33 

34 

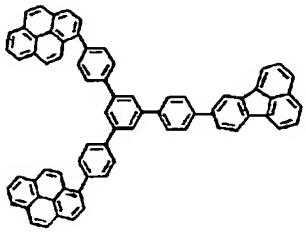
35 

[0072] General formula [V]
[External Character 46]

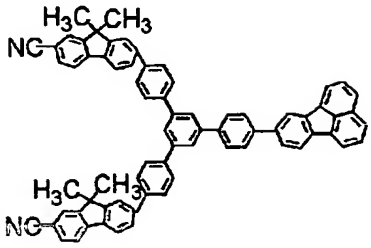


[0073]
[External Character 47]

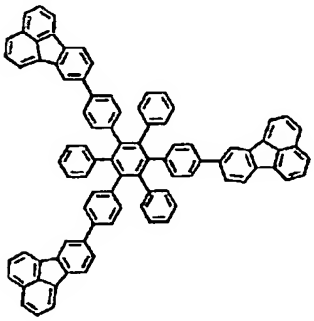
36



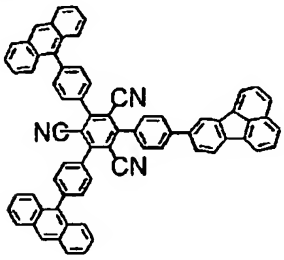
39



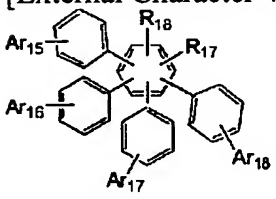
37



38

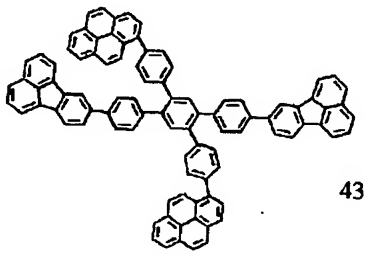


[0074] General formula [VI]
[External Character 48]

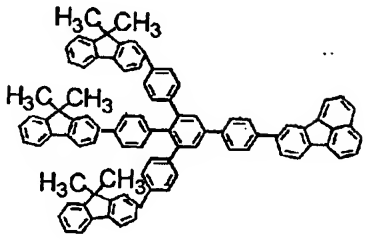


[0075]
[External Character 49]

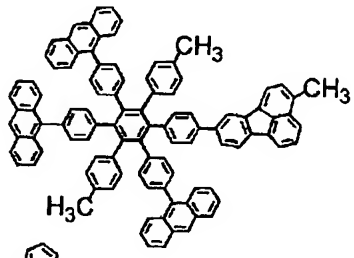
40



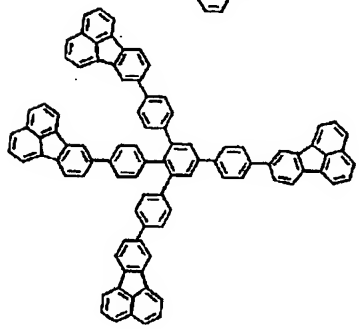
43



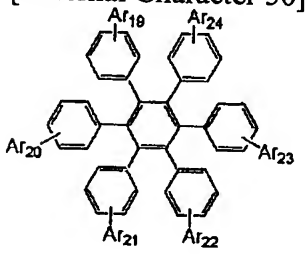
41



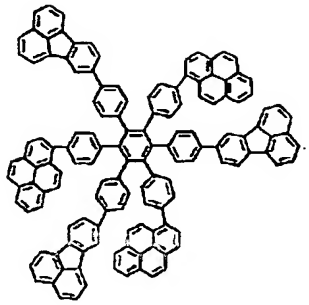
42

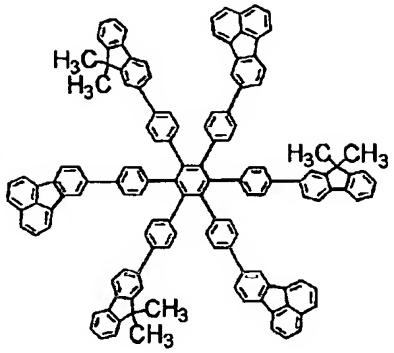


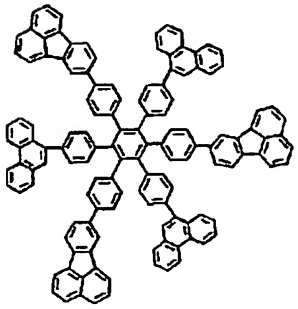
[0076] General formula [VII]
[External Character 50]

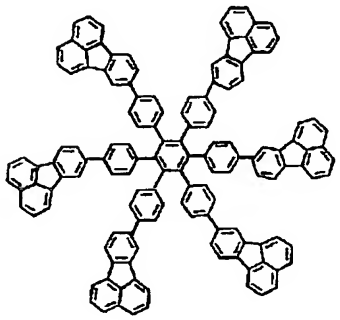


[0077]
[External Character 51]

44 

46 

45 

47 

[0078] The condensed multi-ring compound of this invention is compoundable by the approach generally learned. For example, used suzuki using a palladium catalyst The coupling method (for example, Chem.Rev. 1995, 95, 2457 -2483), It can obtain with synthesis methods, such as the Yamamoto method (2091 for example, Bull.Chem.Soc.Jpn.51, 1978) using a nickel catalyst, and the approach (for example, J.Org.Chem., 52, 4296, 1987) of compounding using an aryl tin compound.

[0079] The condensed multi-ring compound shown by the general formula [I] of this invention - the general formula [VII] is a compound which was excellent in electronic transportability, the luminescence, and endurance compared with the conventional compound, it is useful as an electronic transportation layer and a luminous layer especially, and the layer containing the organic compound of an organic light emitting device and the layer formed by the vacuum deposition method, the solution applying method, etc. are [that crystallization etc. cannot take place easily] excellent in stability with the passage of time.

[0080] Next, the organic light emitting device of this invention is explained to a detail.

[0081] The organic light emitting device of this invention is characterized by the thing of the condensed multi-ring compound in which at least one layer of the layers containing said organic compound is shown by the general formula [I] - the general formula [VII] for which a kind is contained at least in the organic light emitting device which has at least a layer containing the electrode of a pair which consists of an anode plate and cathode, and 1 or two or more organic compounds which were ****(ed) by inter-electrode [of this pair].

[0082] The organic light emitting device of this invention has at least the desirable thing of said condensed multi-ring compound for which an electronic transportation layer or a luminous layer contains a kind at least among the layers containing an organic compound.

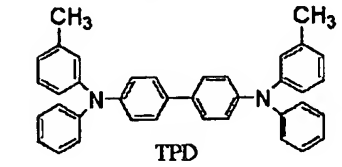
[0083] In the organic light emitting device of this invention, the condensed multi-ring compound shown by the above-mentioned general formula [I] - the general formula [VII] is formed between an anode plate and cathode by the vacuum deposition method or the solution applying method. The thickness of the organic layer is thinner than 10 micrometers, and it is preferably desirable to thin-film-ize in thickness of 0.01-0.5 micrometers more preferably 0.5 micrometers or less.

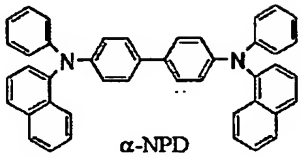
[0084] An example with the organic desirable light emitting device of this invention is shown in drawing 1 - drawing 6 .

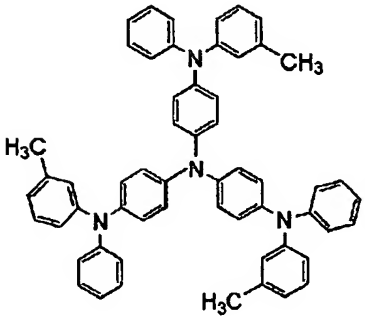
[0085] Drawing 1 is the sectional view showing an example of the organic light emitting device of this invention. Drawing 1 is the thing of a configuration of having formed an anode plate 2, a luminous layer 3, and cathode 4 one by one on the substrate 1. The light emitting device used here is useful, when it is single and has hole transportation

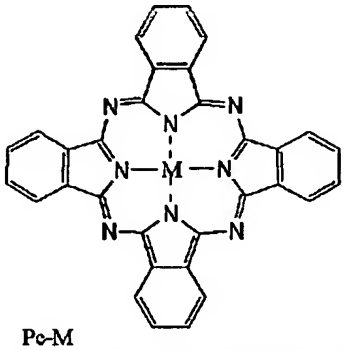
ability, electron transportation ability, and the luminescent engine performance by itself, or when mixing and using the compound which has each property.
[0086] Drawing 2 is the sectional view showing other examples in the organic light emitting device of this invention. Drawing 2 is the thing of a configuration of having formed an anode plate 2, the hole transportation layer 5, the electronic transportation layer 6, and cathode 4 one by one on the substrate 1. in this case, photogene -- hole transportability -- or any of electronic transportability -- or it is useful, when using for each layer the ingredient which has both functions and using combining the mere hole transportation matter or the electronic transportation matter without the luminescence. Moreover, a luminous layer 3 consists in this case of either the hole transportation layer 5 or the electronic transportation layer 6.
[0087] Drawing 3 is the sectional view showing other examples in the organic light emitting device of this invention. Drawing 3 is the thing of a configuration of having formed an anode plate 2, the hole transportation layer 5, a luminous layer 3, the electronic transportation layer 6, and cathode 4 one by one on the substrate 1. Since the various compounds which differ in luminescence wavelength can be used while this separating the function of carrier transportation and luminescence, and combining it hole transportability, electronic transportability, a compound with each luminescent property, and timely, using it and its degree of freedom of ingredient selection increasing extremely, diversification of a luminescent color phase is attained.
[0088] Furthermore, it also becomes possible to confine each carrier or an exciton in a central luminous layer effectively, and to aim at improvement in luminous efficiency.
[0089] Drawing 4 is the sectional view showing other examples in the organic light emitting device of this invention. It is the configuration which inserted the hole impregnation layer 7 in the anode plate side to drawing 3 , and drawing 4 has effectiveness in an adhesion improvement of an anode plate and a hole transportation layer or an injectional improvement of a hole, and is effective for low-battery-izing.
[0090] Drawing 5 and drawing 6 are the sectional views showing other examples in the organic light emitting device of this invention. Drawing 5 and drawing 6 receive drawing 3 and drawing 4 . It is the configuration which inserted the layer (hole blocking layer 8) which checks escaping from a hole or an exciton (exciton) to a cathode side between the luminous layer and the electronic transportation layer. By using the very high compound of ionization potential as a hole blocking layer 8, it is a configuration effective for improvement in luminous efficiency.
[0091] However, drawing 1 - drawing 6 are to the last very fundamental component configurations, and the configuration of the organic light emitting device using the compound of this invention is not limited to these. For example, the glue line or interference layer which prepares an insulating layer in an electrode and an organic layer interface is prepared. A hole transportation layer consists of two-layer [from which ionization potential differs]. **** -- various lamination can be taken.
[0092] The condensed multi-ring compound shown by the general formula [I] used for this invention - the general formula [VII] is a compound which was excellent in electronic transportability, the luminescence, and endurance compared with the conventional compound, and can be used with any gestalt of drawing 1 - drawing 6 .
[0093] Especially the organic layer using the condensed multi-ring compound of this invention is useful as an electronic transportation layer and a luminous layer, and the layer formed by the vacuum deposition method, the solution applying method, etc. is [that crystallization etc. cannot take place easily] excellent in stability with the passage of time.
[0094] Although the condensed multi-ring compound shown by the general formula [I] - the general formula [VII] as a constituent of an electronic transportation layer and a luminous layer is used for this invention, a hole transportability compound, a luminescent compound, or an electronic transportability compound known until now can also be used for it together if needed.
[0095] These examples of a compound are given to below.
[0096] Hole transportability compound [outside 52]

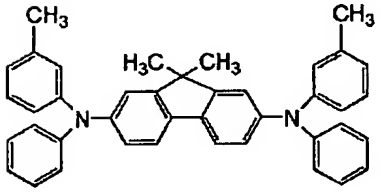
表1　ホール輸送性化合物

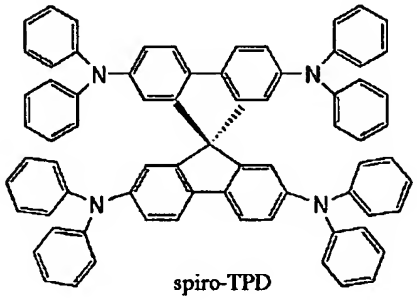

TPD

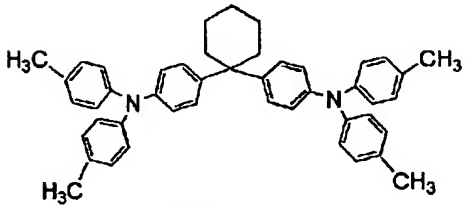

α-NPD

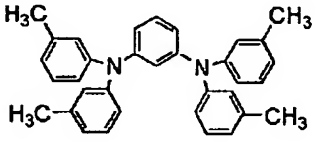

m-MTDATA


Pc-M
M : Cu, Mg, AlCl, TiO, SiCl2, Zn , Sn, MnCl, GaCl, etc

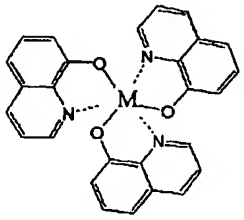

DTDPFL


spiro-TPD

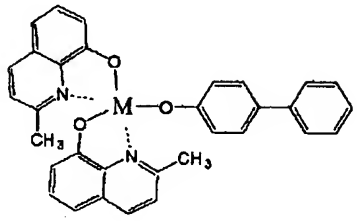

TPAC


PDA

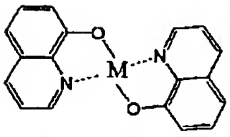
[0097] Electronic transportability luminescent material [outside 53]



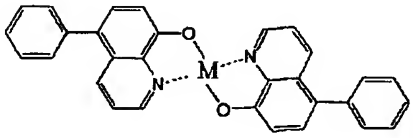
M : Al , Ga



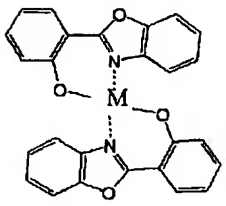
M : Al , Ga



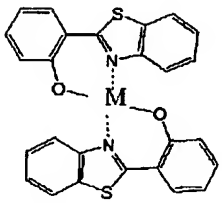
M : Zn , Mg , Be



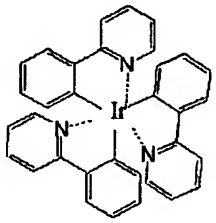
M : Zn , Mg , Be

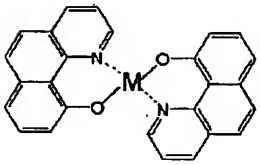


M : Zn , Mg , Be

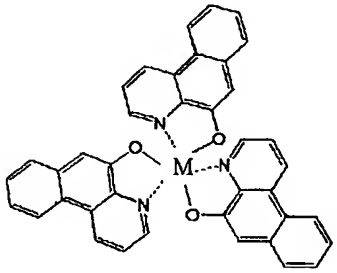


M : Zn , Mg , Be



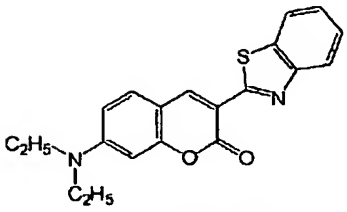


M : Zn , Mg , Be

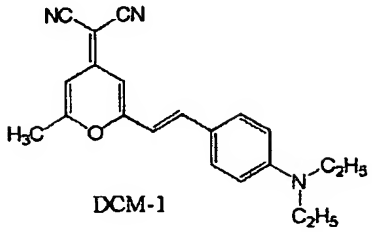


M : Al , Ga

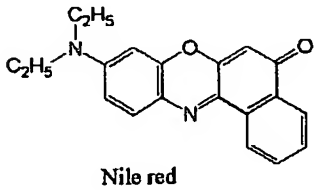
[0098] Luminescent material [outside 54]



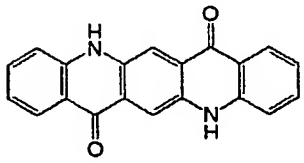
Coumarin6



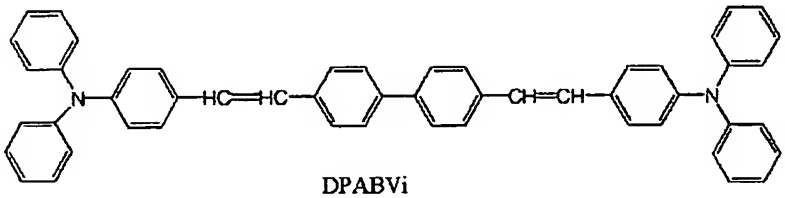
DCM-1



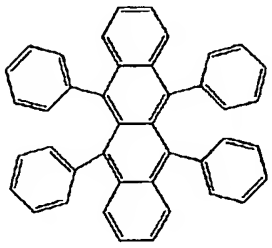
Nile red



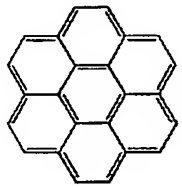
Quinacridone



DPABVi



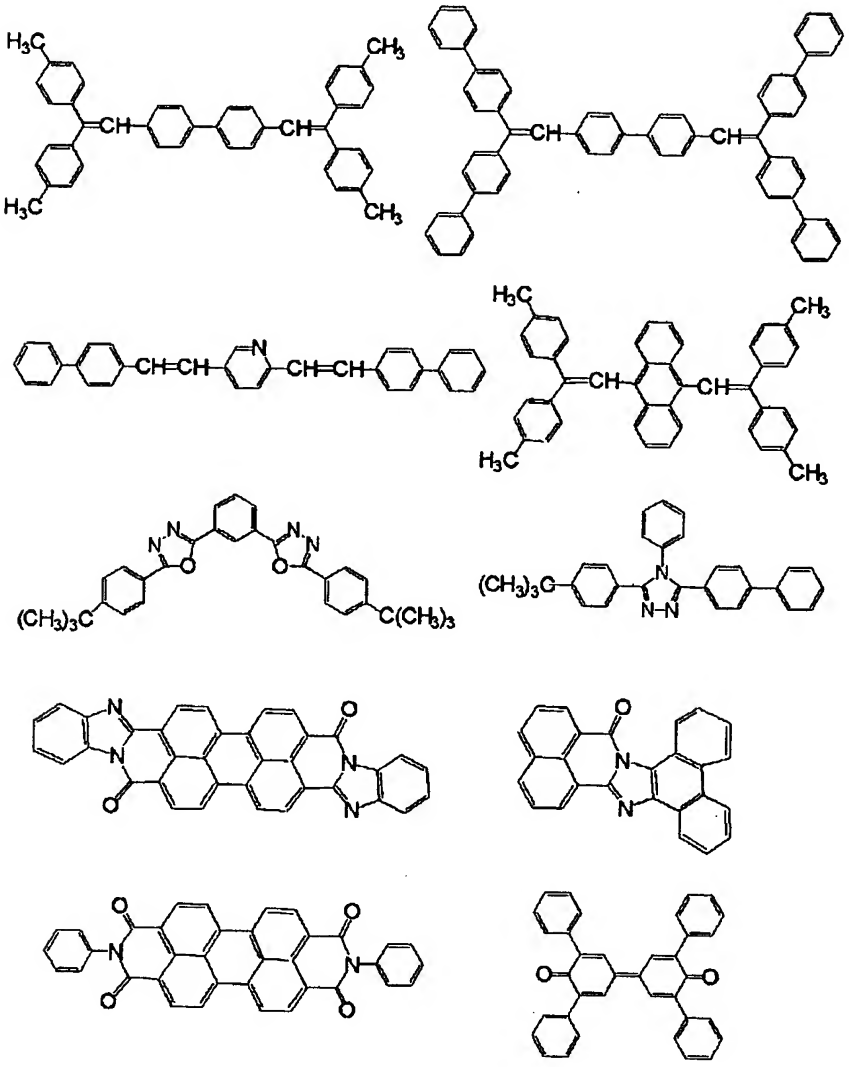
Rubrene



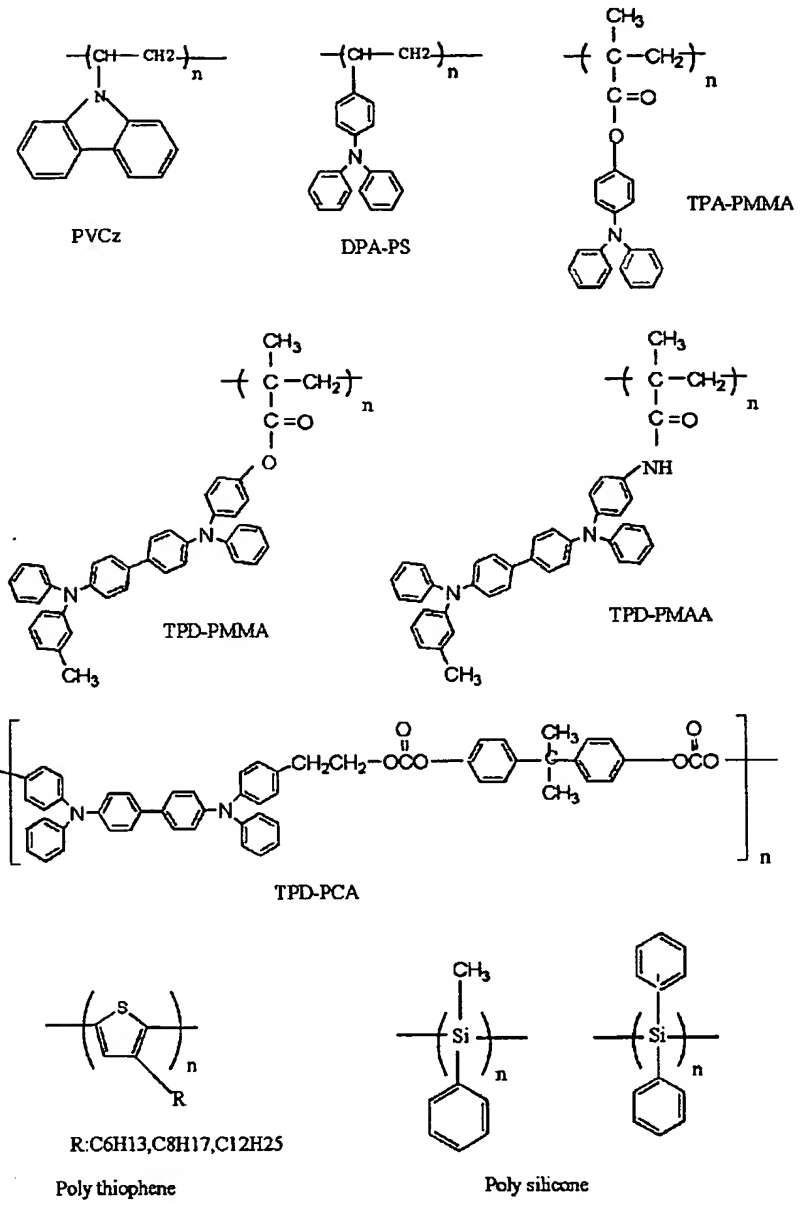
Coronene

[0099] A luminous layer matrix material and an electronic transportation ingredient [outside 55]

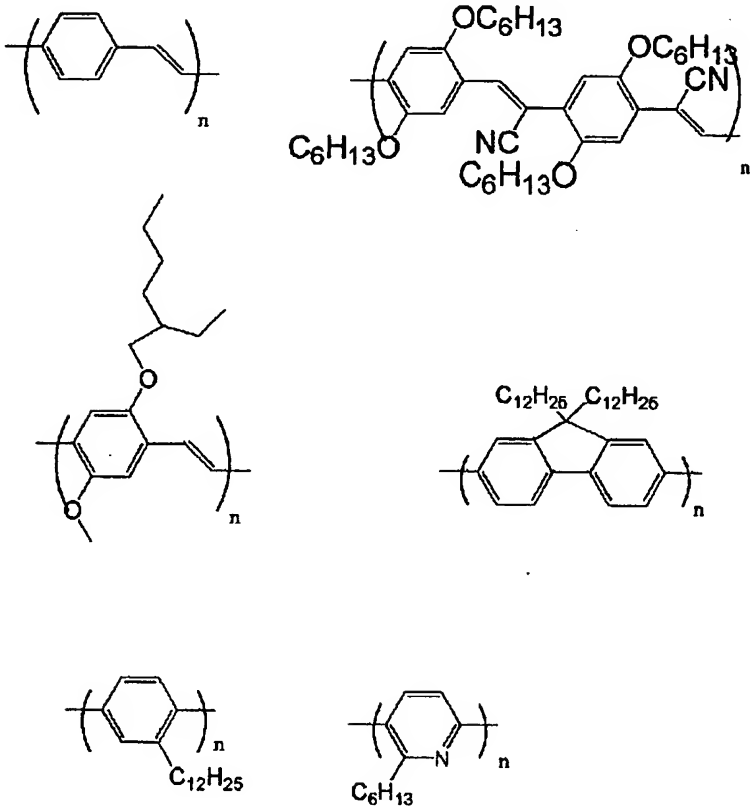
表4　発光層マトリックス材料および電子輸送材料



[0100] Polymer system hole transportability ingredient [outside 56]



[0101] Polymer system luminescent material and a charge transportability ingredient [outside 57]



[0102] In the organic light emitting device of this invention, generally, it is made to dissolve in a vacuum deposition method or a suitable solvent, and the layer containing the layer containing the condensed multi-ring compound shown by the general formula [I] - the general formula [VII] and other organic compounds forms a thin film by the applying method. When forming membranes especially by the applying method, the film can also be formed combining suitable binding resin.

[0103] Although it can choose from bending resin wide range as the above-mentioned binding resin, for example, polyvinyl-carbazole resin, polycarbonate resin, polyester resin, polyarylate resin, polystyrene resin, acrylic resin, methacrylic resin, butyral resin, polyvinyl-acetal resin, diallyl phthalate resin, phenol resin, an epoxy resin, silicone resin, polysulfone resin, a urea-resin, etc. are mentioned, it is not limited to these. moreover -- as that these are independent or a copolymer polymer -- one sort -- or two or more sorts may be mixed.

[0104] What has as big a work function as an anode material as possible is good, for example, metallic oxides, such as metal simple substances, such as gold, platinum, nickel, palladium, cobalt, a selenium, and vanadium, or these alloys, tin oxide, a zinc oxide, a tin oxide indium (ITO), and a zinc oxide indium, can be used. Moreover, conductive polymers, such as the poly aniline, polypyrrole, the poly thiophene, and a polyphenylene sulfide, can also be used. Such electrode material may be used independently and can also be used together. [two or more]

[0105] On the other hand, as a cathode material, the small thing of a work function is good and can use as a metal simple substance or two or more alloys, such as a lithium, sodium, a potassium, calcium, magnesium, aluminum, an indium, silver, lead, tin, and chromium. Use of metal oxidation, such as a tin oxide indium (ITO), is also possible. Moreover, a configuration is much more sufficient as cathode, and it can also take a multilayer configuration.

[0106] Especially as a substrate used by this invention, although it does not limit, transparency substrates, such as opaque substrates, such as a metal substrate and a substrate made from the ceramics, glass, a quartz, and a sheet plastic, are used. Moreover, it is also possible to use the color filter film, the fluorescence color conversion filter film, the dielectric reflective film, etc. for a substrate, and to control coloring light.

[0107] In addition, to the created component, a protective layer or a closure layer can also be prepared in order to prevent contact with oxygen, moisture, etc. As a protective layer, a photo-setting resin etc. is mentioned to poly membrane pans, such as inorganic material film, such as a diamond thin film, a metallic oxide, and a metal nitride,

fluorine resin, poly paraxylene, polyethylene, silicone resin, and polystyrene resin. Moreover, glass, a gas impermeable film, a metal, etc. can be covered and packaging of the component itself can also be carried out with suitable closure resin.

[0108]

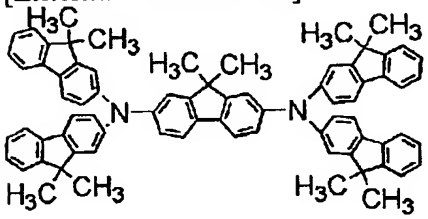
[Example] Hereafter, although the example explains this invention still more concretely, this invention is not limited to these.

[0109] The component of the structure shown in [example 1] drawing 2 was created.

[0110] On the glass substrate as a substrate 1, what formed the tin oxide indium (ITO) as an anode plate 2 by 120nm thickness in the spatter was used as a transparent conductive support substrate. Sequential ultrasonic cleaning of this was carried out by the acetone and isopropyl alcohol (IPA), and, subsequently it dried after boiling washing in IPA. Furthermore, what carried out UV / ozone washing was used as a transparent conductive support substrate.

[0111] On the transparent conductive support substrate, the chloroform solution of the compound shown with the following structure expression was formed by 30nm thickness with the spin coat method, and the hole transportation layer 5 was formed.

[External Character 58]



[0112] The condensed multi-ring compound furthermore shown by instantiation compound No.11 was formed by 50nm thickness with the vacuum deposition method, and the electronic transportation layer 6 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.

[0113] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %). The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 1.0 - 1.2 nm/sec.

[0114] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 10V was impressed, the current flowed for the component with the current density of 9.3 mA/cm2, and blue luminescence was observed by the brightness of 1400 cd/m2.

[0115] Furthermore, when current density was maintained at 7.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 1000 cds/m2, and brightness degradation were small 100 hours after initial brightness 1100 cd/m2.

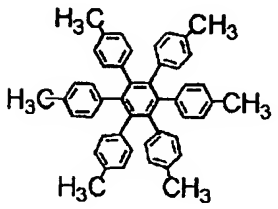
[0116] Replaced with [examples 2-10] instantiation compound No.11, and instantiation compound No.1, and 13, 22, 26, 27, 32, 39, 42 and 44 were used, and also the component was created like the example 1, and same evaluation was performed.

[0117] A result is shown in Table -1.

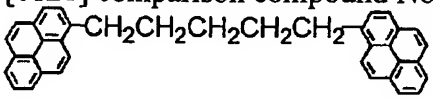
[0118] It replaced with [examples 1-8 of comparison] instantiation compound No.11, and the compound shown with the following structure expression was used, and also the component was created like the example 1, and same evaluation was performed.

[0119] A result is shown in Table -1.

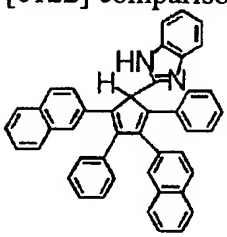
[0120] comparison compound No.1 -- [External Character 59]



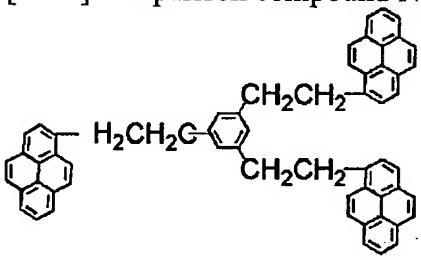
[0121] comparison compound No.2 -- [External Character 60]



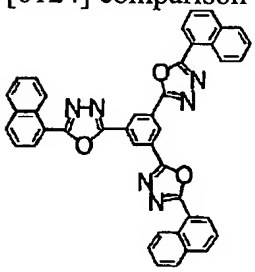
[0122] comparison compound No.3 -- [External Character 61]



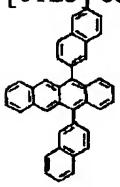
[0123] comparison compound No.4 -- [External Character 62]



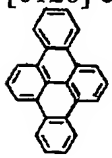
[0124] comparison compound No.5 -- [External Character 63]



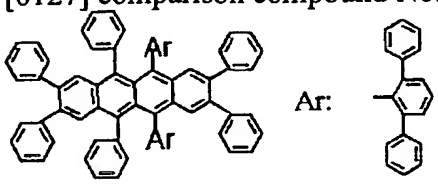
[0125] comparison compound No.6 -- [External Character 64]



[0126] comparison compound No.7 -- [External Character 65]



[0127] comparison compound No.8 -- [External Character 66]



[0128]
[Table 1]
表－1

例No.	例示化合物No.	初期 印加電圧(V)	初期 輝度(cd/m²)	耐久(電流密度)7.0mA/cm²	初期輝度(cd/m²)	100時間後輝度(cd/m²)
実施例1	11	10	1400		1100	1000
2	1	10	840		680	640
3	13	10	1000		820	770
4	22	10	1100		1000	970
5	26	10	1800		1500	1400
6	27	10	1700		1500	1300
7	32	10	820		700	670
8	39	10	1100		960	900
9	42	10	1700		1400	1200
10	44	10	1900		1700	1600
比較例1	比較1	10	150		110	20
2	比較2	10	70		50	発光せず
3	比較3	10	100		70	発光せず
4	比較4	10	90		70	発光せず
5	比較5	10	150		90	発光せず
6	比較6	10	300		220	50
7	比較7	10	190		160	20
8	比較8	10	330		260	90

[0129] The component of the structure shown in [example 11] drawing 3 was created.
[0130] The hole transportation layer 5 was formed on the transparent conductive support substrate like the example 1.
[0131] The condensed multi-ring compound furthermore shown by instantiation compound No.11 was formed by 20nm thickness with the vacuum deposition method, and the luminous layer 3 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.
[0132] Furthermore, aluminum tris quinolinol was formed by 40nm thickness with the vacuum deposition method, and the electronic transportation layer 6 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.
[0133] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %), and the component of the structure shown in drawing 3 was created. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 1.0 - 1.2 nm/sec.
[0134] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 8V was impressed, the current flowed for the component with the current density of 8.4 mA/cm2, and blue luminescence was observed by the brightness of 8500 cd/m2.
[0135] Furthermore, when current density was maintained at 7.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 6400 cds/m2, and brightness degradation were small 100 hours after initial brightness 7600 cd/m2.
[0136] Replaced with [examples 12-20] instantiation compound No.11, and instantiation compound No.6, and 9, 15, 20, 24, 35, 37, 43 and 46 were used, and also the component was created like the example 11, and same evaluation was performed.
[0137] A result is shown in Table -2.

[0138] Replaced with [examples 9-16 of comparison] instantiation compound No.11, and comparison compound No.1, and 2, 3, 4, 5, 6, 7 and 8 were used, and also the component was created like the example 11, and same evaluation was performed.

[0139] A result is shown in Table -2.

[0140]

[Table 2]

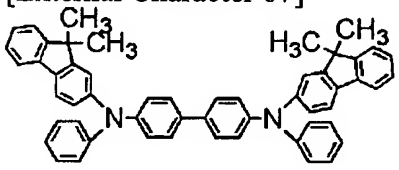
表－2

例No.	例示化合物No.	初期 印加電圧 (V)	初期 輝度 (cd/m^2)	耐久 (電流密度) 7.0mA/cm^2	初期 輝度 (cd/m^2)	100時間後 輝度 (cd/m^2)
実施例11	11	8	8500		7600	6400
12	6	8	4500		3700	3000
13	9	8	7900		6900	5700
14	15	8	8200		7400	6400
15	20	8	9000		7900	7000
16	24	8	8100		7200	6400
17	35	8	5300		4800	4200
18	37	8	7700		7000	6400
19	43	8	9200		8000	6800
20	46	8	8500		7400	6700
比較例9	比較1	8	660		480	80
10	比較2	8	470		440	発光せず
11	比較3	8	370		300	発光せず
12	比較4	8	490		420	発光せず
13	比較5	8	660		510	発光せず
14	比較6	8	1600		1000	170
15	比較7	8	1100		870	110
16	比較8	8	2200		1400	410

[0141] The component of the structure shown in [example 21] drawing 3 was created.

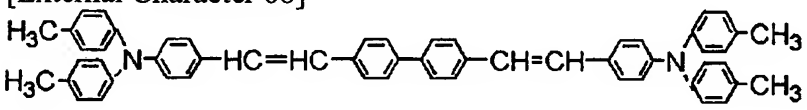
[0142] On the same transparent conductive support substrate as an example 1, the chloroform solution of the compound shown with the following structure expression was formed by 20nm thickness with the spin coat method, and the hole transportation layer 5 was formed.

[External Character 67]



[0143] The condensed multi-ring compound (weight ratio 1:50) shown by the compound furthermore shown with the following structure expression and instantiation compound No.11 was formed by 20nm thickness with the vacuum deposition method, and the luminous layer 3 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.

[External Character 68]



[0144] Furthermore, aluminum tris quinolinol was formed by 40nm thickness with the vacuum deposition method, and the electronic transportation layer 6 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.

[0145] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %), and the component of the structure shown in drawing 3 was created. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on

condition that 1.0 - 1.2 nm/sec.
[0146] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 8V was impressed, the current flowed for the component with the current density of 8.8 mA/cm2, and blue luminescence was observed by the brightness of 82000 cd/m2.
[0147] Furthermore, when current density was maintained at 5.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 33000 cds/m2, and brightness degradation were small 100 hours after initial brightness 39000 cd/m2.
[0148] Replaced with [examples 22-30] instantiation compound No.11, and instantiation compound No.2, and 10, 14, 21, 25, 30, 36, 40 and 47 were used, and also the component was created like the example 21, and same evaluation was performed.
[0149] A result is shown in Table -3.
[0150] Replaced with [examples 17-24 of comparison] instantiation compound No.11, and comparison compound No.1, and 2, 3, 4, 5, 6, 7 and 8 were used, and also the component was created like the example 21, and same evaluation was performed. A result is shown in Table -3.
[0151]
[Table 3]
表－3

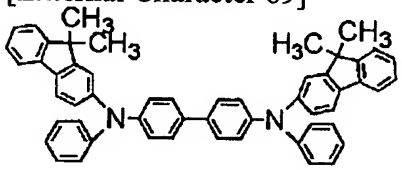
例No.	例示化合物No.	初期 印加電圧 (V)	初期 輝度 (cd/m²)	耐久 (電流密度) 5.0mA/cm²	初期 輝度 (cd/m²)	100時間後 輝度 (cd/m²)
実施例21	11	8	82000		39000	33000
22	2	8	43000		24000	19000
23	10	8	88000		46000	35000
24	14	8	79000		35000	30000
25	21	8	86000		43000	34000
26	25	8	87000		42000	37000
27	30	8	45000		27000	23000
28	36	8	77000		37000	30000
29	40	8	83000		42000	37000
30	47	8	93000		49000	37000
比較例17	比較1	8	1200		690	140
18	比較2	8	810		560	発光せず
19	比較3	8	680		400	発光せず
20	比較4	8	720		390	発光せず
21	比較5	8	1300		910	160
22	比較6	8	5900		2700	920
23	比較7	8	3400		1900	810
24	比較8	8	7200		3500	1400

[0152] The component of the structure shown in [example 31] drawing 5 was created.
[0153] The hole transportation layer 5 was formed on the transparent conductive support substrate like the example 21. After forming rubrene and aluminum tris quinolinol (weight ratio 1:20) by 20nm thickness with the vacuum deposition method furthermore and forming a luminous layer 3, the condensed multi-ring compound shown by instantiation compound No.11 was formed by 10nm thickness with the vacuum deposition method, and the hole / exciton blocking layer 8 was formed. Furthermore, aluminum tris quinolinol was formed by 40nm thickness with the vacuum deposition method, and the electronic transportation layer 6 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.
[0154] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %), and the component of the structure shown in drawing 5 was created. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 1.0 - 1.2 nm/sec.
[0155] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 10V was impressed, the current flowed for the component with the current density of 9.1 mA/cm2, and luminescence yellow-green by the brightness of 81000 cd/m2 was observed.

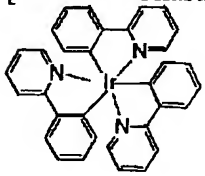
[0156] Furthermore, when current density was maintained at 7.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 39000 cds/m2, and brightness degradation were small 100 hours after initial brightness 51000 cd/m2.
[0157] Replaced with [examples 32-40] instantiation compound No.11, and instantiation compound No.3, and 7, 18, 19, 28, 31, 38, 41 and 45 were used, and also the component was created like the example 31, and same evaluation was performed.
[0158] A result is shown in Table -4.
[0159] Replaced with [examples 25-32 of comparison] instantiation compound No.11, and comparison compound No.1, and 2, 3, 4, 5, 6, 7 and 8 were used, and also the component was created like the example 31, and same evaluation was performed. A result is shown in Table -4.
[0160]
[Table 4]
表－4

例No.	例示化合物No.	初期印加電圧(V)	輝度 (cd/m²)	耐久(電流密度) 7.0 mA/cm²	初期輝度 (cd/m²)	100時間後輝度 (cd/m²)
実施例31	11	10	81000		51000	39000
32	3	10	45000		31000	23000
33	7	10	40000		27000	21000
34	18	10	63000		43000	32000
35	19	10	87000		57000	45000
36	28	10	88000		60000	46000
37	31	10	53000		37000	31000
38	38	10	62000		40000	30000
39	41	10	45000		33000	25000
40	45	10	72000		56000	44000
比較例25	比較1	10	1000		680	130
26	比較2	10	770		420	発光せず
27	比較3	10	700		440	発光せず
28	比較4	10	710		440	発光せず
29	比較5	10	1100		800	200
30	比較6	10	5500		2500	870
31	比較7	10	2900		1800	610
32	比較8	10	8000		3800	900

[0161] The component of the structure shown in [example 41] drawing 3 was created.
[0162] On the same transparent conductive support substrate as an example 1, the chloroform solution of the compound shown with the following structure expression was formed by 20nm thickness with the spin coat method, and the hole transportation layer 5 was formed.
[External Character 69]



[0163] The condensed multi-ring compound (weight ratio 1:50) shown by the compound furthermore shown with the following structure expression and instantiation compound No.11 was formed by 20nm thickness with the vacuum deposition method, and the luminous layer 3 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.
[External Character 70]



[0164] Furthermore, aluminum tris quinolinol was formed by 40nm thickness with the vacuum deposition method, and

the electronic transportation layer 6 was formed. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 0.2 - 0.3 nm/sec.
[0165] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %), and the component of the structure shown in drawing 3 was created. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 1.0 - 1.2 nm/sec.
[0166] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 8V was impressed, the current flowed for the component with the current density of 7.7 mA/cm2, and green luminescence was observed by the brightness of 12000 cd/m2.
[0167] Furthermore, when current density was maintained at 5.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 7800 cds/m2, and brightness degradation were small 100 hours after initial brightness 8600 cd/m2.
[0168] Replaced with [examples 42-50] instantiation compound No.11, and instantiation compound No.4, and 8, 12, 16, 23, 29, 34, 43 and 44 were used, and also the component was created like the example 41, and same evaluation was performed.
[0169] A result is shown in Table -5.
[0170] Replaced with [examples 33-40 of comparison] instantiation compound No.11, and comparison compound No.1, and 2, 3, 4, 5, 6, 7 and 8 were used, and also the component was created like the example 41, and same evaluation was performed. A result is shown in Table -5.
[0171]
[Table 5]
表－5

例No.	例示化合物 No.	初期 印加電圧 (V)	輝度 (cd/m^2)	耐久 (電流密度) 5.0 mA/cm^2	初期 輝度 (cd/m^2)	100時間後 輝度 (cd/m^2)
実施例41	11	8	12000		8600	7800
42	4	8	8500		5900	5000
43	8	8	7600		5000	4400
44	12	8	13000		9900	8700
45	16	8	13000		10000	8500
46	23	8	11000		7700	7100
47	29	8	10000		7100	6400
48	34	8	7400		4800	4200
49	43	8	9700		6700	6000
50	44	8	10000		7400	6600
比較例33	比較1	8	290		200	発光せず
34	比較2	8	440		320	50
35	比較3	8	350		250	発光せず
36	比較4	8	890		710	70
37	比較5	8	450		390	30
38	比較6	8	330		280	発光せず
39	比較7	8	560		480	90
40	比較8	8	530		460	120

[0172] The component of the structure shown in [example 51] drawing 1 was created.
[0173] On the same transparent conductive support substrate as an example 1, the solution which dissolved 0.050g and Polly N-vinylcarbazole (weight average molecular weight = 63,000) 1.00g for the condensed multi-ring compound shown by instantiation compound No.11 in chloroform 80ml was formed to 120nm thickness with the spin coat method (rotational frequency = 2000rpm), and the organic layer (luminous layer 3) was formed.
[0174] Next, the metal layer membrane with a thickness of 150nm was formed with the vacuum deposition method on the above-mentioned organic layer as cathode 4 using the vacuum evaporationo ingredient which consists of aluminum and a lithium (lithium concentration 1 atom %), and the component of the structure shown in drawing 5 was created. The degree of vacuum at the time of vacuum evaporationo formed 1.0x10 to 4 Pa, and a membrane formation rate on condition that 1.0 - 1.2 nm/sec.
[0175] Thus, when the ITO electrode (anode plate 2) was used the obtained component, the positive electrode and the

aluminum-Li electrode (cathode 4) were used as the negative electrode and the direct current voltage of 10V was impressed, the current flowed for the component with the current density of 7.5 mA/cm2, and blue luminescence was observed by the brightness of 1400 cd/m2.

[0176] Furthermore, when current density was maintained at 5.0 mA/cm2 under nitrogen-gas-atmosphere mind and the electrical potential difference was impressed for 100 hours, 870 cds/m2, and brightness degradation were small 100 hours after initial brightness 920 cd/m2.

[0177] Replaced with [examples 52-55] instantiation compound No.11, and instantiation compound No.5, and 17, 33 and 47 were used, and also the component was created like the example 51, and same evaluation was performed. A result is shown in Table -6.

[0178] Replaced with [examples 41-48 of comparison] instantiation compound No.11, and comparison compound No.1, and 2, 3, 4, 5, 6, 7 and 8 were used, and also the component was created like the example 51, and same evaluation was performed. A result is shown in Table -6.

[0179]

[Table 6]

表－6

例No.	例示化合物No.	初期印加電圧(V)	輝度(cd/m^2)	耐久(電流密度) 5.0 mA/cm^2	初期輝度(cd/m^2)	100時間後輝度(cd/m^2)
実施例51	11	10	1400		920	870
52	5	10	970		670	620
53	17	10	1300		840	770
54	33	10	930		640	600
55	47	10	1600		1100	1000
比較例41	比較1	10	240		150	発光せず
42	比較2	10	140		90	発光せず
43	比較3	10	90		70	発光せず
44	比較4	10	100		70	発光せず
45	比較5	10	250		150	発光せず
46	比較6	10	350		240	40
47	比較7	10	340		240	30
48	比較8	10	430		290	90

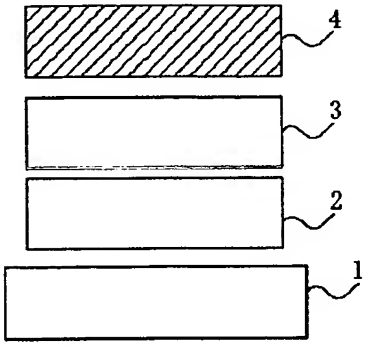
[0180]

[Effect of the Invention] applied voltage with the organic light emitting device above low like explanation using the condensed multi-ring compound shown by the general formula [I] - the general formula [VII] -- high -- brightness luminescence is obtained and it excels also in endurance. The organic layer containing especially the condensed multi-ring compound of this invention is excellent as an electronic transportation layer, and excellent also as a luminous layer.

[0181] Furthermore, it can create using vacuum deposition or the casting method, and creation of a component is also comparatively cheap and can create the component of a large area easily.

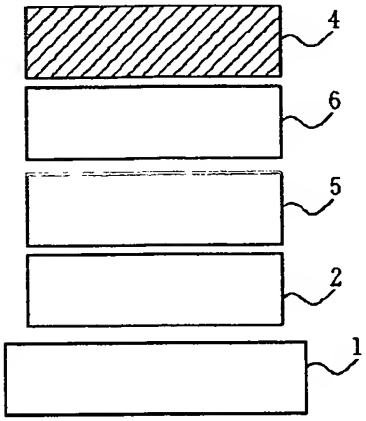
[Translation done.]

Drawing selection drawing 1



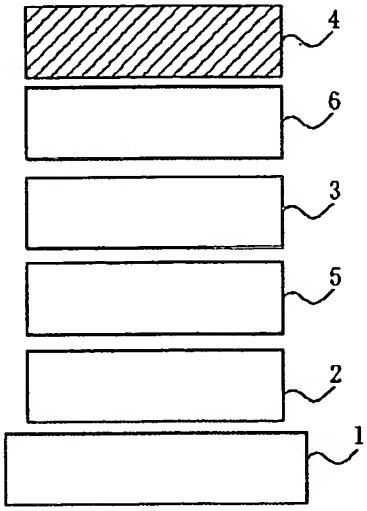
[Translation done.]

Drawing selection drawing 2



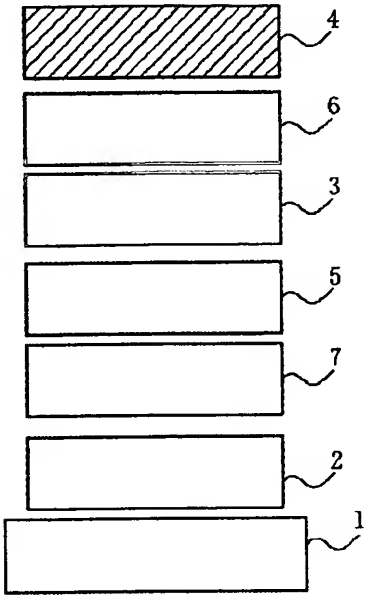
[Translation done.]

Drawing selection drawing 3



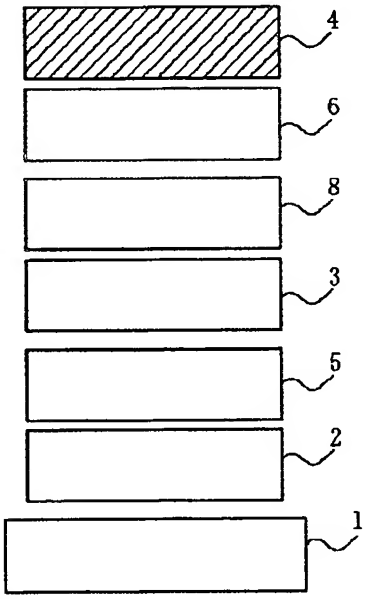
[Translation done.]

Drawing selection drawing 4



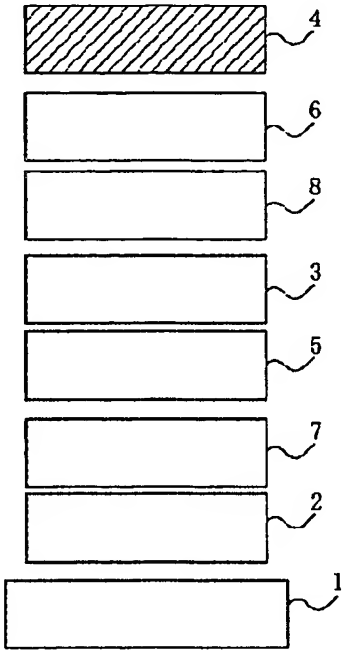
[Translation done.]

Drawing selection drawing 5



[Translation done.]

Drawing selection drawing 6



[Translation done.]